

# PROPOSED TAXONOMIC REVISION OF SOME IMPORTANT PENAEID PRAWN GENERA (CRUSTACEA : DECAPODA) OF KONKAN COAST (WEST COAST OF INDIA) <sup>1</sup>

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(With fifty-three text-figures)

**Key words :** taxonomic revision, penaeid prawns, *Penaeus* (*Fenneropenaeus*) *merguiensis*, *Metapenaeus* (?) *dobsoni*, *Metapenaeus kutchensis*, *Parapenaeopsis stylifera*, *Acetes indicus*, *Acetes sibogae* complex.

During the faunistic study of penaeid prawns of the Konkan coast (west coast of India), represented by 29 species belonging to 3 families and 9 genera, several taxonomic problems were encountered. In depth systematic studies have indicated the need for the following taxonomic revisions : (1) *Penaeus* (*Fenneropenaeus*) *merguiensis* De Man 1888: The Australian/Pacific Ocean form assigned to this species differs from the typical Afro-Asian/Indian Ocean form at specific, or atleast subspecific level. (2) *Metapenaeus dobsoni* (Miers, 1878): One of the oldest proposals of assigning *M. dobsoni* as a genotype of *Mangalura* is further strengthened by its distinctiveness when compared with the remaining species of *Metapenaeus*, except *M. joyneri* (Miers, 1880). (3) *Metapenaeus kutchensis* George, George & Rao, 1963 : It is a valid species and not a synonym of *M. affinis* (H. Milne Edwards, 1837). (4) *Parapenaeopsis stylifera* (H. Milne Edwards, 1837): *P. stylifera* s.s. is a widely distributed species along both coasts of India and exhibits considerable variation in the number of fixed spines on telson. Both *P. coromandelica*/*P. stylifera coromandelica* (from east coast of India) and *P. stylifera cochinchinensis* (from southwest coast of India) should be treated as its junior synonyms only. However, all the remaining species of *Parapenaeopsis* differ from this genotype in several features, warranting independent generic status. (5) *Acetes indicus* H. Milne Edwards, 1830 : The morphological variations between Indo-Burmese and East Asian forms are not size-linked but are indicative of distinct geographic stocks, thereby justifying a separate nomenclature for the latter form. (6) 'Acetes sibogae Hansen, 1919 complex': A thorough revision of *A. sibogae* complex is essential for understanding the extent/degree of inter and intraspecific variations among its members. Nevertheless, the Konkan material differs from all the remaining west coast forms assigned to *A. sibogae* but is identical with widely separated coastal Andhra Pradesh (east coast) material, and both together may eventually require a separate taxonomic status.

## INTRODUCTION

The small maritime town of Ratnagiri (Konkan belt of Maharashtra State, west coast of India) is one of the major penaeid prawn landing, processing and export centres in India. The prawn fishery of this area is multigeneric

and multispecific. Yet, surprisingly, information available on it is very scanty despite the fact that systematics of this group is not only essential in determining species-wise exploitable resources, but also applies to processing industry, aquaculture etc. The present investigation was, therefore, initiated with the twin objectives of (i) Systematic treatment of penaeid prawn resources of Konkan, particularly for the benefit of carcinologists, research workers, fisheries

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scientists etc. and (ii) To formulate a field-key for the benefit of industry personnel, suppliers, fishermen and prawn farmers of the region.

Detailed systematic study revealed that the prawn fauna of Konkan region is represented by 29 species belonging to 3 families and 9 genera. However, several taxonomic doubts arose while carrying out detailed analyses of individual species. It was strongly felt that at least some species need nomenclatural revisions and these are dealt with in the present paper.

1. *Penaeus (Fenneropenaeus) merguensis*  
De Man, 1888

*Penaeus merguensis* De Man, 1888 : 227 (Type locality : Mergui archipelago, Burma/Myanmar) ; *Penaeus indicus* - Bate, 1888 : 248 (NON H. Milne Edwards, 1837); *Peneus indicus* var *merguensis* - Alcock, 1905 : 515; *Peneus merguensis* - Schmitt, 1926 : 360; NOT *Penaeus merguensis* - Racek, 1955 : 221 (= a new form ?); *Penaeus (Fenneropenaeus) merguensis* - Perez Farfante, 1969 : 466.

**Material examined :** 1523 males (80 to 160 mm) and 1716 females (75 to 190 mm) collected at Mirkarwada and Sakhartar Fish Landing Centres as well as in and around Konkan Krishi Vidyapeeth's Brackish Water Fish Farm (BWFF) from April 1989 to December 1991.

**Remarks :** *P. (F.) merguensis* is the most important commercial species with good culture prospects along the south Konkan coast. The Konkan specimens, like all other Afro-Asian / Indian ocean material belonging to *P. (F.) merguensis*, possesses a distinct gastro-orbital carina as in De Man's type specimens from Mergui Archipelago (Alcock, 1906; Kubo, 1949; Hall, 1956, 1962; Cheung, 1960; Joubert, 1965; Chong and Sasekumar, 1982). This carina, however, is totally lacking in the individuals from Australia and Philippines/Pacific Ocean, assigned to the same species (Dall, 1957; Hall, 1962; Racek and Dall, 1965; Grey *et al.*, 1983). The present investigation has further revealed that the two forms also differ in several other characters as shown in Table 1.

TABLE 1

COMPARISON OF AFRO-ASIAN / INDIAN OCEAN (= TYPICAL) FORM OF *PENAEUS (FENNEROPENAEUS) MERGUIENSIS* DE MAN, 1888 WITH THAT OF AUSTRALIAN & PHILIPPINES / PACIFIC OCEAN FORM ASSIGNED TO IT.

Characters	Afro-Asian / Indian Ocean (= Typical) form	Australian & Philippines / Pacific Ocean form
1. Gastro-orbital carina	Present.	Absent.
2. No. of cicatrices on 5th abdominal segment:	2	1
3. Petasma :		
(A) Structure / Shape:	Stout, blunt and squarish.	Slender, pointed anteriorly and triangular.
(B) Distomedian projection:	Short, stout, bent laterally and subequal to ventral costa.	Slender, straight and distinctly longer than ventral costa.
(C) Distal spines of ventral costa :	Situated away from distomedian projections.	Situated just below distomedian projections.
(D) Tip of ventral costa	Ending in a prominent denticle.	Smoothly rounded without denticle.
4. Distal piece of appendix masculina	With numerous stout spines.	Without spines but with only long setae.
5. Thelycum :		
(A) Anterior process:	Covering posterior process completely.	Covering posterior process only partially (anteriorly).
(B) Posterior process:	A distinct, short, triangular piece.	A long piece with a narrow, elongated neck.

Even the larvae of the above two forms exhibit several important differences including number of nauplius stages during their metamorphosis (Raje and Ranade, 1972 ; Motoh and Buri, 1979).

In view of these differences, the Pacific Ocean stock merits a separate taxonomic status.

## 2. *Metapenaeus (?) dobsoni* (Miers, 1878) (Figs. 1-20)

*Penaeus dobsoni* Miers, 1878 : 302 {Type locality : Mangalur (= Mangalore) coast, Karnataka State, India} ; *Mangalura dobsoni* Miers, 1878 : 303 ; *Metapenaeus dobsoni* - Nobili, 1903 : 3 ; *Metapeneus dobsoni* - Alcock, 1906 : 21 ; *Penaeopsis dobsoni* - De Man, 1911 : 60 ; *Metapenaeus dobsoni choprai* - Nataraj, 1942 : 468 .

**Material examined** : 1547 males (12.5 to 63.5 mm) and 1720 females (16.5 to 82.5 mm) collected from Mirkarwada Fish Landing Centre as well as in and around BWFF from April, 1989 to December, 1991.

**Remarks** : *M. dobsoni* is one of the most widely distributed and extensively studied

penaeids. However, its generic status has created quite a lot of controversy. Miers (1878), the original author, observed that his species was quite unique in possessing (1) Triangular distal segment of mandibular palp (2) Slender third maxilliped (3) Rudimentary 5th pereopods. But since his collection lacked males, he refrained from assigning it to the proposed new genus *Mangalura* (named after the type locality Mangalore, Karnataka State). This name remained unused until Burkenroad (1963a) pointed out its priority over the more popular generic name *Metapenaeus* of Wood-Mason and Alcock (1891). However, this generated a controversy since Holthuis (1962) had recommended to the International Commission on Zoological Nomenclature (ICZN) suppression of such unfamiliar names under its plenary powers, with a view to safeguarding the continuity of well established names to avoid unnecessary confusion. Burkenroad (1963b) responded by proposing to revise the genus *Metapenaeus*. Holthuis (1963), therefore, modified his recommendation based on which the ICZN, in its 1969 Addendum, included both *Metapenaeus* (Name No. 1829) and *Mangalura* (Name No.

TABLE 2

COMPARISON OF *METAPENAEUS (?) DOBSONI* (MIERS, 1878) WITH THE OTHER FIVE SPECIES OF *METAPENAEUS* (INCLUDING *M. BREVICORNIS*) OCCURRING ALONG THE KONKAN COAST

Characters	<i>Metapenaeus (?) dobsoni</i> (Miers, 1878)	Other species of <i>Metapenaeus</i> from the Konkan coast
1. FINGER PALM (A) First cheliped: (B) Second cheliped: (C) Third cheliped:	0.40 to 0.60 0.30 to 0.50 0.20 to 0.40 (i.e. Fingers distinctly shorter than even half of Palm.)	1.30 to 2.00 1.20 to 2.10 0.90 to 1.60 (i.e. Fingers distinctly longer than entire Palm.)
2. THIRD MAXILLIPED: (A) Dactylus: (B) Merus:	More than 2/3 rd of ( 0.70 to 0.90-times ) Ischium. Longer than (1.30 to 1.60-times ) Ischium.	Less than 2/3 rd of ( 0.30 to 0.60 times ) Ischium. Shorter than ( 0.60 to 1.00-times ) Ischium.
3. ABDOMEN: (A) Pleura of first segment (B) Fourth segment: (C) Fifth segment:	Protruding anteriorly. With 1 cicatrix. With 1 cicatrix.	Anteriorly straight, without any protrusion. With NO cicatrices. With 3 cicatrices.

TABLE 2 (contd)  
COMPARISON OF *METAPENAEUS* (?) *DOBSONI* (MIERS, 1878) WITH THE OTHER FIVE SPECIES OF  
*METAPENAEUS* (INCLUDING *M. BREVICORNIS*) OCCURRING ALONG THE KONKAN COAST

Characters	<i>Metapenaeus</i> (?) <i>dobsoni</i> (Miers, 1878)	Other species of <i>Metapenaeus</i> from the Konkan coast
(D) Sixth segment :	With 1 cicatrix.	With 4 or 5 cicatrices.
4. ROSTRUM:		
(A) Distal gap Distance between last two teeth	More than 5	Less than 5.
5. ANTENNULE :		
(A) Upper flagella:	Shorter than ( 0.70 to 0.94 times ) lower flagella	Longer than ( 1.01 to 1.32 times) lower flagella.
(B) Number of non aesthetasc bearing segments on upper flagella:		
(I) Males:	Less than 3.	More than 4.
(II) Females:	Less than 8.	More than 9.
6. MANDIBULAR PALP:		
(A) Distal segment:	Triangular in shape.	Quadrangular in shape.
7. FIRST MAXILLA PALP :		
(A) Distal segment:	Long, slender and bearing a strong apical spine.	Short, stout and bearing a few apical hair-like setae.
8. ZYGOCARDIAC OSSICLE:		
(A) Number of teeth in Upper row :	17 to 20	10 to 15
(B) Number of teeth in Lower row:	20 to 27	07 to 16
9. THIRD PEREIOPOD (CHELIPED) BASIAL SPINE:	Exhibits sexual dimorphism - simple in females but in males modified into a strong elongated barbed structure extending beyond ischium	Does not exhibit sexual dimorphism - simple and similar in both sexes.
10. FIFTH PEREIOPOD:		
(A) Females:	In specimens above 75 mm, invariably broken (during copulation?) and represented only as a rudimentary structure.	Well developed, as in males, irrespective of size.
(B) Males:	Merus with TWO triangular teeth - both without any basal notch.	Merus with ONLY ONE spine or tubercle (of varied size and shape) - with a distinct basal notch.
11. DORSAL ASPECT OF PETASMA:	Inner margins of distolateral projections with a pair of spinulose hooks.	Inner margins of distolateral projection without any spinulose hooks.
12. COXAL PLATES OF FOURTH PEREIOPODS :	Extended into hood-like projections over anterior plate of thelycum.	Simple, smooth and not forming hood over anterior plate of thelycum.
13. UROPODS:		
(A) Outer margin of exopod:	Similar in both sexes - straight without any basal concavity.	Straight in females, but in males with a deep or shallow basal concavity.
(B) Colouration :	Distally with fluorescent yellow colouration.	Without any fluorescent yellow colouration.

1830) in its official list of Zoological Generic Names but without giving *Mangalura* precedence over *Metapenaeus*.

Unfortunately Burkenroad could not complete his proposed revision and the issue of giving validity to the generic name *Mangalura* has remained unattended. This is only possible by designating its genotype. The present observations clearly indicate that *M. dobsoni* should be designated as a genotype of *Mangalura* since it distinctly differs in more than 20 characters (Table 2, Figs. 1-20) from all the remaining 5 species of *Metapenaeus* inhabiting the Konkan coast viz. *M. brevicornis* (H. Milne Edwards, 1837), *M. moyebi* (Kishinouye, 1896), *M. monoceros* (Fabricius, 1798), *M. affinis* (H. Milne Edwards, 1837) and *M. kutchensis* George, George and Rao, 1963.

Whether these differences are restricted only to *M. dobsoni* proper or they hold true for the entire *M. dobsoni* complex which in-

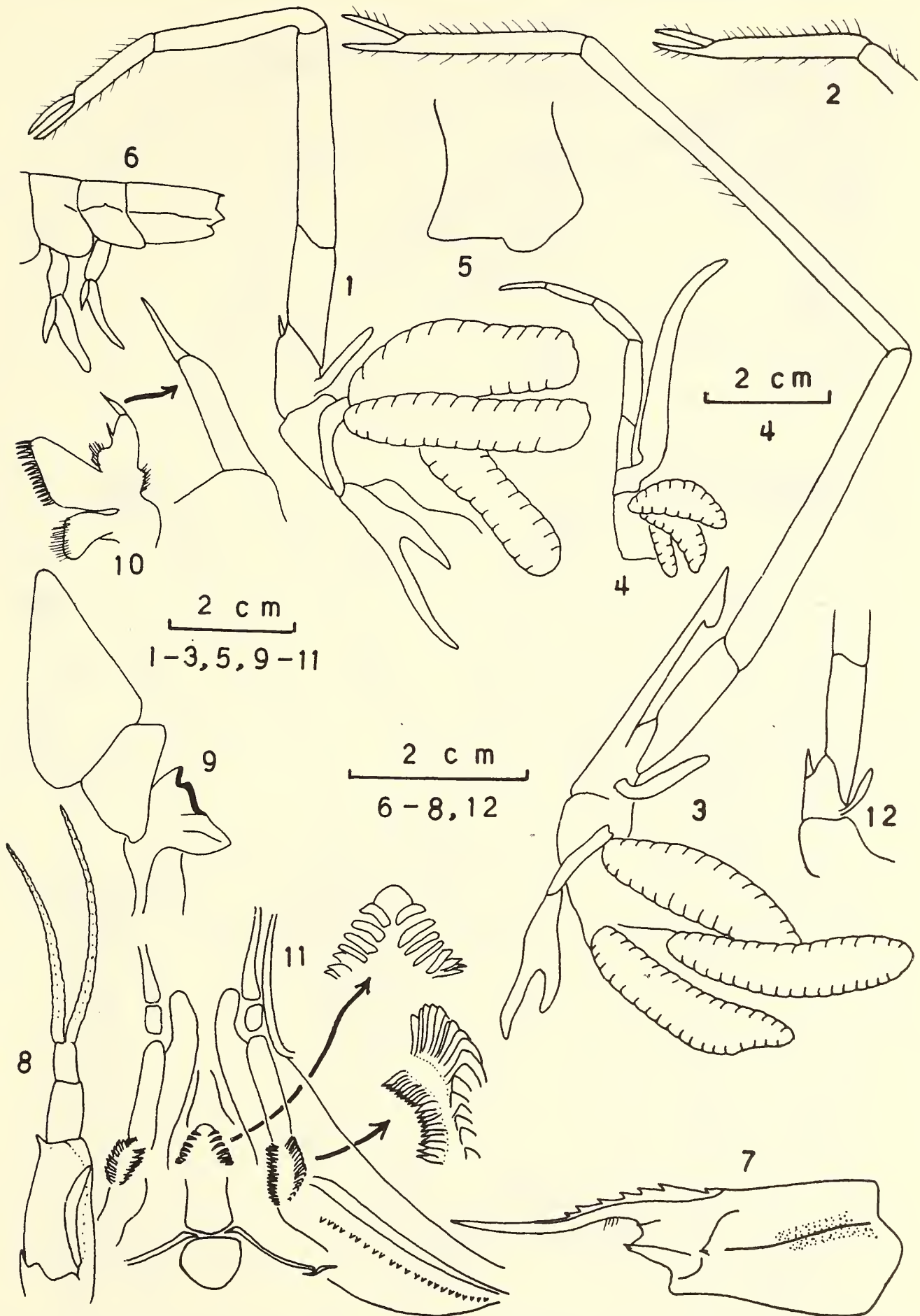
cludes species like *M. joyneri* (Miers 1880), *M. brevicornis* (H. Milne Edwards, 1837), *M. lysianassa* (De Man, 1888) and *M. tenuipes* Kubo, 1949 (cf. Racek & Dall, 1965; Miquel, 1982), is rather difficult to surmise at present, unless all these species are extensively studied. The present investigation has clearly revealed that atleast *M. brevicornis* is closer to the remaining species of *Metapenaeus* than to *M. dobsoni*. In fact, only *M. joyneri* is close to *M. dobsoni* in possessing (1) Characteristic barbed basal spine on 3rd cheliped of male (2) Lateral plates of thelycum partially covering the median plate (3) A blunt (hook-like ?) projection dorsally along inner margin of distolateral projection of petasma (Miquel, 1982, Fig. 41 p.100 and Liu *et al.*, 1986, Fig. 110 p.179).

In view of the above, it is hereby proposed to revalidate *Mangalura* Miers, 1878 by designating *M. dobsoni* as its genotype and including *M. joyneri* under that genus.

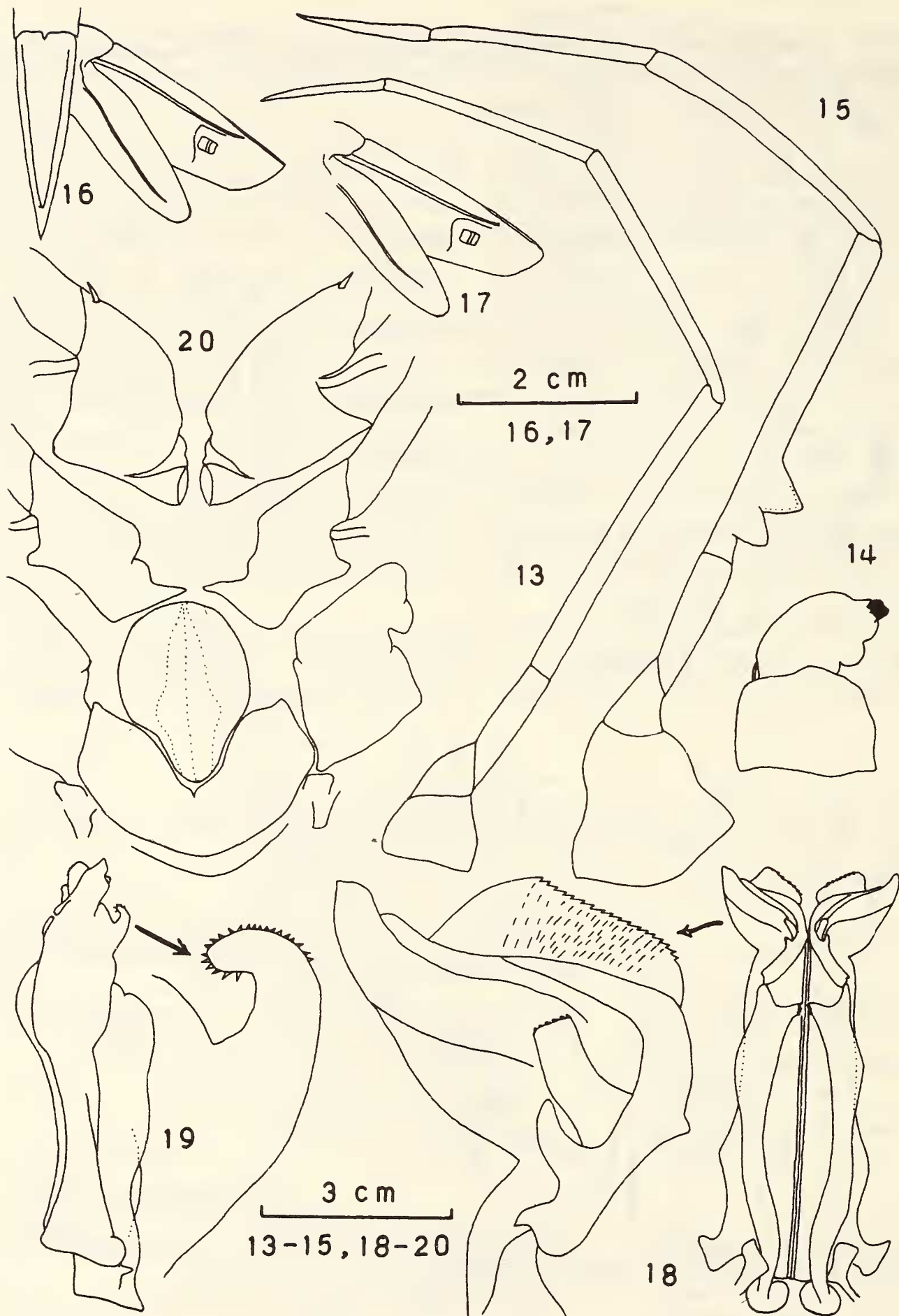
TABLE 3

COMPARISON BETWEEN *METAPENAEUS KUTCHENSIS* GEORGE, GEORGE & RAO, 1963 AND *M. AFFINIS* (H. MILNE EDWARDS, 1837)

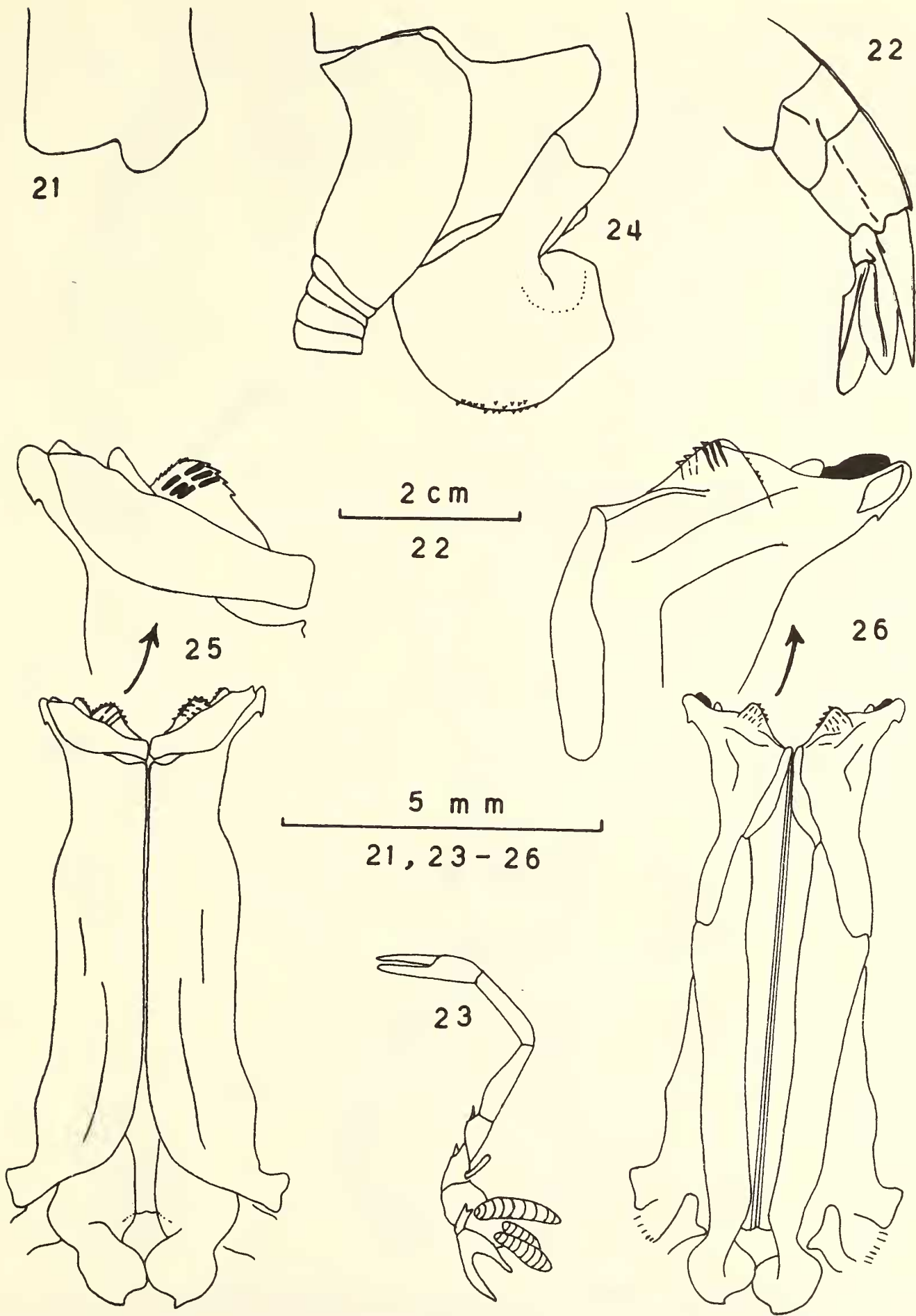
Characters	<i>Metapenaeus kutchensis</i> George <i>et al.</i>	<i>M. affinis</i> (H. Milne Edwards)
1. Abdomen		
(A) Pleura of 1st segment:	Conspicuously projecting ahead forming an acute angle behind median notch.	Broadly curved behind median notch.
(B) Cicatrices on 6th segment:	Distal 2 cicatrices arranged at lower level than proximal 3 cicatrices.	All 5 cicatrices arranged almost in a continuous line.
2. Ischium of first periopod:	Invariably with a distinctly sharp spine.	Without, or either with a blunt or distinctly sharp spine.
3. Meral tooth of fifth periopod in male:	Straight and without basal notch.	Bent down and with a basal notch.
4. Distomedian projections petasma:		
(A) Structure / Shape:	Smaller than or subequal to distolateral projections, thereby partially exposing their apical openings ventrally	Larger, extending beyond or completely covering distolateral projections along with their apical openings ventrally.
(B) Channel between dorsal and ventral lobes:	Rather shallow.	Very deep.
5. Apex of anterior plate of thelycum:	Mostly concave or depressed and without bunch of cilia.	Mostly rounded, rarely depressed, and with characteristic bunch of cilia.



Figs. 1-12. *Metapenaeus (?) dobsoni* (Miers, 1878): 1. first pereiopod; 2. second pereiopod (fingers & palm); 3. third pereiopod of male; 4. third maxilliped; 5. pleura of first abdominal segment; 6. fourth to sixth abdominal segments; 7. carapace + rostrum (lateral view); 8. antennule; 9. mandible; 10. first maxilla; 11. gastric mill; 12. third pereiopod of female (basal portion).

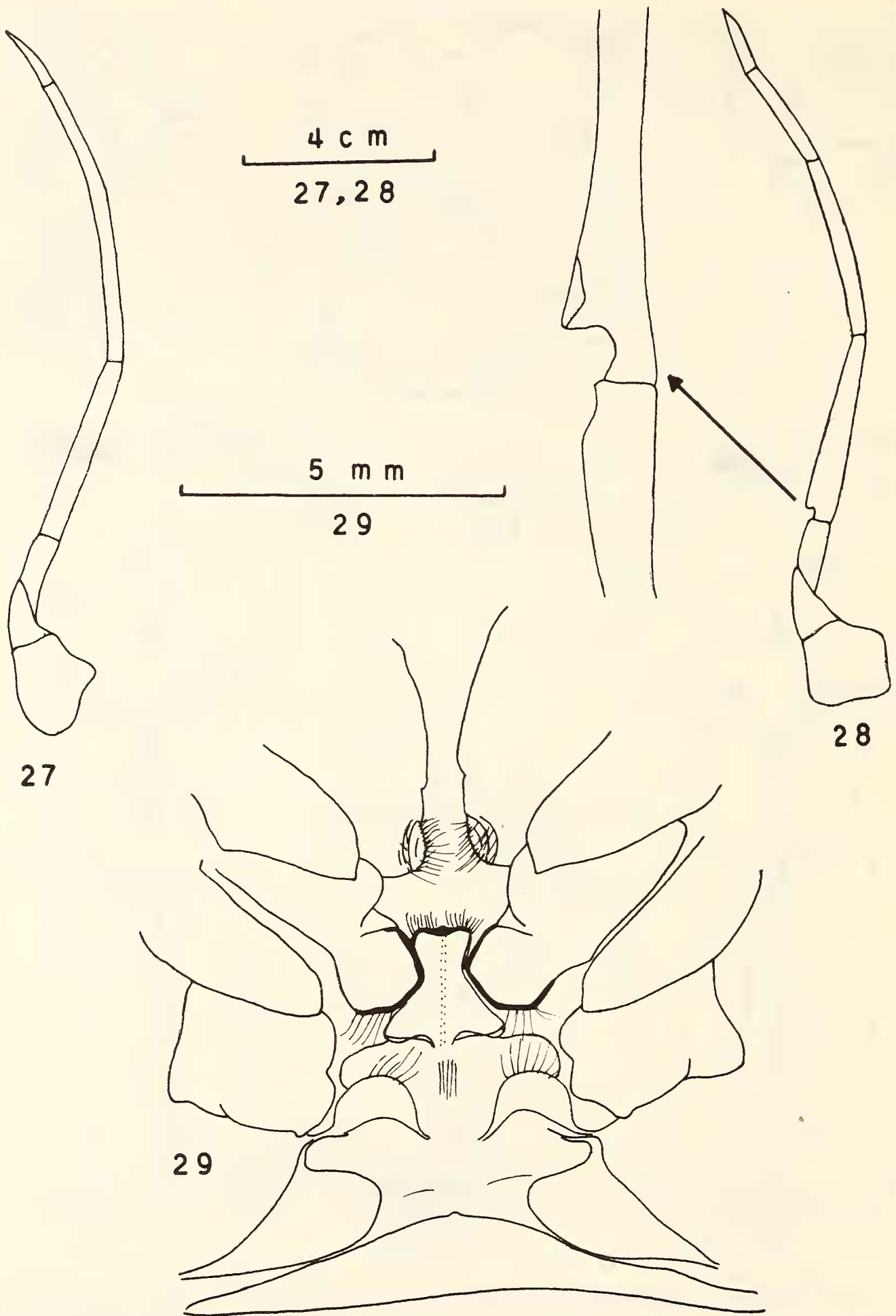


Figs. 13-20 *Metapenaeus* (?) *dobsoni* (Miers, 1878): 13. intact (unbroken) fifth pereiopod of female; 14. broken / rudimentary fifth pereiopod of female; 15. fifth pereiopod of male; 16. telson + uropods of male; 17. uropods of females; 18. petasma (dorsal view); 19. petasma (lateral view); 20. thelycum.

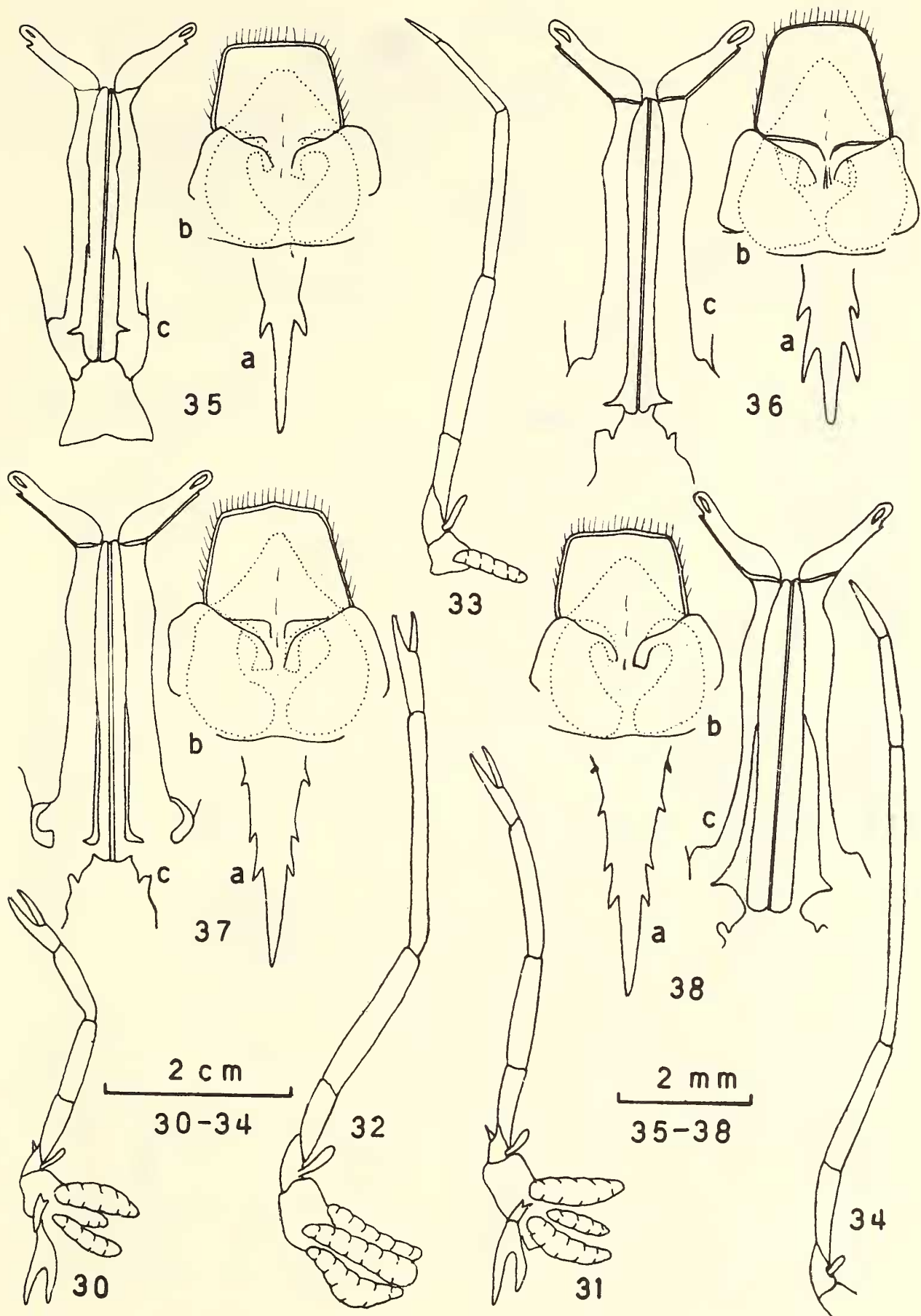


Figs. 21-26. *Metapenaeus kutchensis* George, George & Rao, 1963: 21. pleura of first abdominal segment; 22. fifth & sixth abdominal segments; 23. first pereiopod; 24. appendix masculina; 25. petasma (ventral view); 26. petasma (dorsal view).

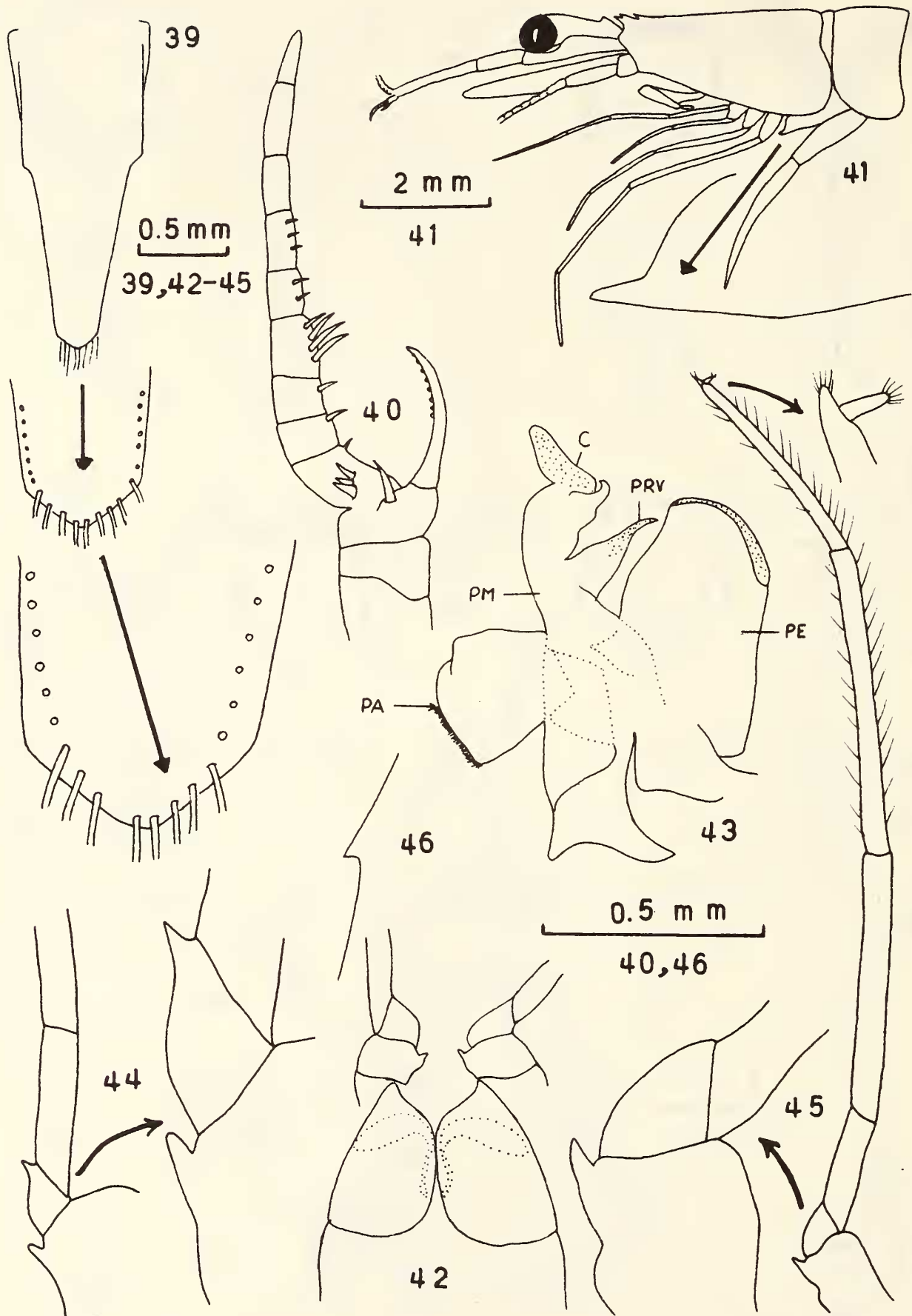




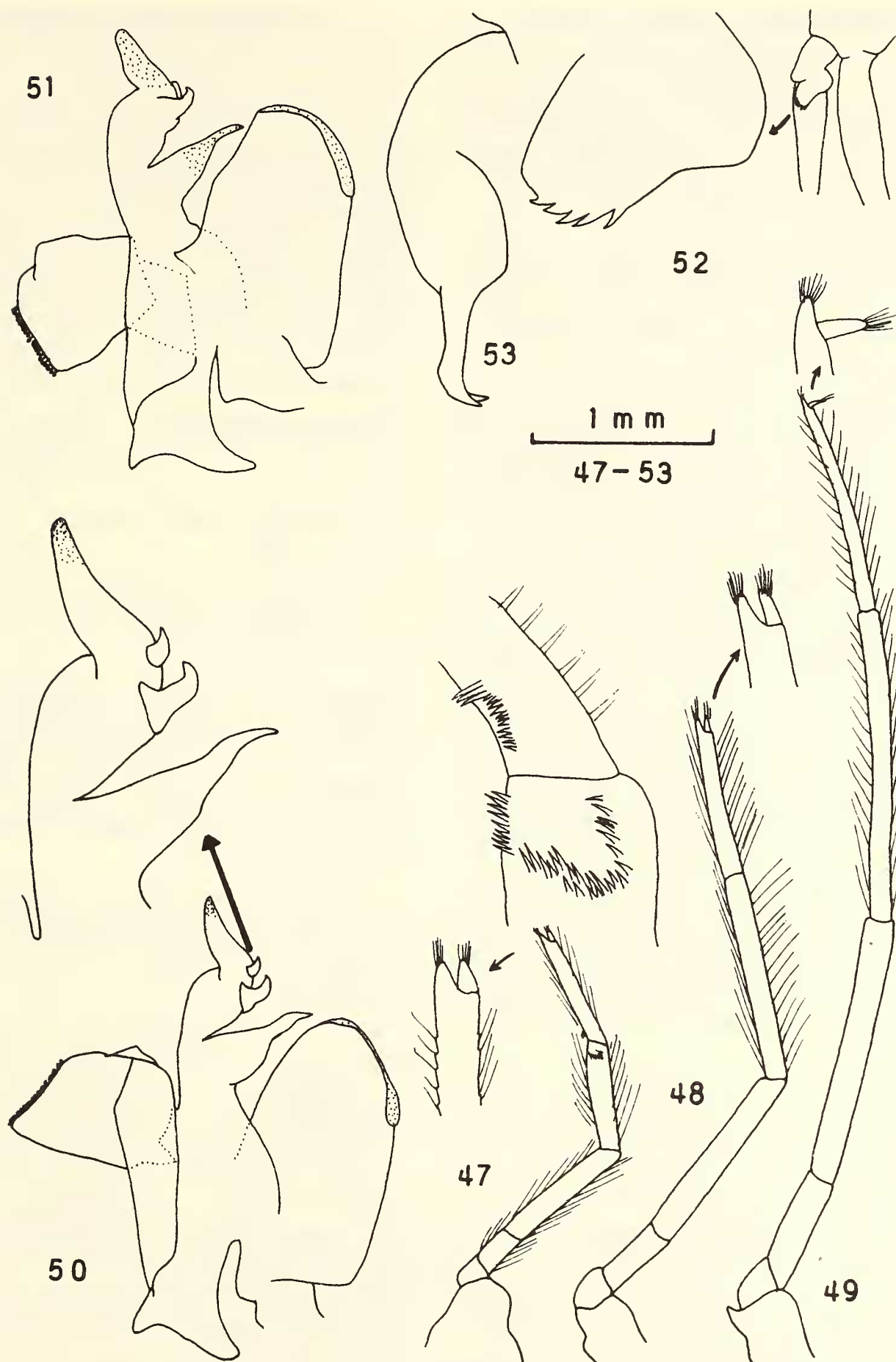
Figs. 27-29. *Metapenaeus kutchensis* George, George & Rao, 1963: 27. fifth pereiopod of female; 28. fifth pereiopod of male; 29. thelycum.



Figs. 30-38. *Parapenaeopsis stylifera* (H. Milne Edwards, 1837): 30. first pereopod; 31. second pereopod; 32. third pereopod; 33. fourth pereopod; 34. fifth pereopod; 35. specimens with 1 pair of fixed spines on telson; 36. specimens with 2 pairs of fixed spines on telson; 37. specimens with 3 pairs of fixed spines on telson; 38. specimens with 4 pairs of fixed spines on telson; a. telson; b. thelycum; c. petasma.



Figs. 39-46 *Acetes sibogae* (?) Hansen, 1919: 39. telson; 40. lower antennular flagellum of male; 41. genital coxa of male (lateral view); 42. genital coxa of male (dorsal view); 43. petasma (improper mounting-distal / second falcate spine completely hidden); 44. third pereiopod of female (basal portion): 45. third pereiopod of male; 46. exopod of uropod showing outer spine; C, capitulum; PA, pars astringens; PE, pars externa; PM, pars media; PRV, processus ventralis.



Figs. 47-53. *Acetes sibogae* (?) Hansen, 1919: 47. first pereiopod; 48. second pereiopod; 49. third pereiopod; 50. petasma (proper mounting-showing both falcate spines clearly); 51. petasma (improper mounting-distal / second falcate spine partially hidden); 52. appendix masculina; 53. appendix masculina (lateral view).

### 3. *Metapenaeus kutchensis* George,

George & Rao, 1963

(Figs. 21-29)

*Metapenaeus affinis* Alcock, 1906:20 (part); *Metapenaeus kutchensis* George, George and Rao, 1963 : 284 (Type locality : Gulf of Kutch, Gujarat State, India).

**Material examined:** 5 males (118.5 to 123 mm) and 5 females (122.5 to 136.5 mm) collected from New Ferry Wharf, Mumbai (= Bombay), on 24th November, 1990.

**Remarks:** The specific status of *M. kutchensis* was rather uncertain for nearly two decades mainly owing to the confused systematic position of *M. affinis* (H. Milne Edwards, 1837), its closely allied species (Mistakidis, 1968). Based on the original description and figures, Miquel (1982) had synonymised it with *M. affinis* during his revision of the genus *Metapenaeus*. But later, the examination of the holotype of *M. kutchensis* convinced Miquel (1983) that the two are really distinct species, differing from each other mainly in (1) thickness of petasma (2) configuration of petasma (3) shape of meral tooth of fifth pereopod of males. The present study has shown that while 2 & 3 above are really valid, the same is not true for the character number 1. In fact, the two species can now be readily distinguished based on other additional characters (Table 3, Figs. 21-29).

In view of the above findings, it is now clear that figures of thelycum and petasma attributed to *M. affinis* by Alcock (1906) and Kubo (1954), actually belong to the present species. This is not at all surprising since all the specimens studied by Kubo (1954) and part of the material examined by Alcock (1906) originated from Karachi (Pakistan), very near to the Gulf of Kutch from where *M. kutchensis* was originally described (George *et al.*, 1963; George, 1980). *M. kutchensis* has also been reported from Mumbai by Kagwade (1978), who redescribed it on the basis of larger specimens.

### 4. *Parapenaeopsis stylifera*

(H. Milne Edwards, 1837)

(Figs. 30-38)

*Penaeus styliferus* H. Milne Edwards, 1837 : 418 {Type locality: Around Mumbai (= Bombay), Maharashtra State, India}; *Penaeopsis styliferus* - Bate, 1881 : 183; *Parapenaeopsis styliferus* - Nobili, 1903 : 4; *Parapeneopsis stylifera* - Alcock, 1906 : 36; *Parapeneopsis stylifera* var. *coromandelica* - Alcock, 1906 : 37; *Parapenaeopsis stylifera* - DeMan, 1911:9; *Parapenaeopsis coromandelica* - Hall, 1962 : 27; *Parapenaeopsis stylifera stylifera* - Racek & Dall, 1965 : 98; *Parapenaeopsis stylifera coromandelica* - Racek & Dall, 1965 : 98; ? *Parapenaeopsis stylifera* var. *cochinensis* George, 1973 : 420; *Parapenaeopsis mumbayensis* - Aravindakshan, 1996 : 32.

**Material examined:** 2517 males (32.5 to 97.5 mm) and 2832 females (91.5 to 118.0 mm) collected at Mirkarwada and Sakhartar Fish Landing Centres and Ratnagiri fish market from April 1989 to December 1991; 6 males (60 to 84 mm) and 3 females (96 to 105.5 mm) collected at Alibag fish market (Raigad district) on 26th February, 1991.

**Remarks:** *P. stylifera* s.s. distinctly stands apart from all the remaining species of *Parapenaeopsis* (Alcock, 1901) in possessing fixed spines on telson (Menon, 1956 ; Dall, 1957; Hall, 1962 ; George, 1969a, 1980; Burukovskii, 1982; Grey *et al.* 1983; De Freitas, 1984 ; Miquel, 1984). However, it is the number of these very spines which has created a lot of confusion.

The crux of the problem is whether the variety *P. stylifera coromandelica* of Alcock (1906), supposedly an inhabitant of the Bay of Bengal (along Coromandel coast) and east of it and characterised by at the most 2 pairs (usually only 1) of telson spines is 1. A synonym of *P. stylifera* (cf. George, 1969a, 1974, 1980) or 2. A subspecies of *P. stylifera* (cf. Racek & Dall, 1965; Ravindranath, 1989) or 3. A separate species (cf. Hall, 1962 ; De Bruin, 1965; Holthuis, 1980; Miquel, 1983).

Examination of an extensive series of material in the present study has clearly shown that the geographical isolation of the two forms, with their so called hybridization zone situated somewhere along the Kerala coast (southwest coast of India), as postulated by Ravindranath (1989), is not acceptable since the entire range of the telson spines (i.e. 1 to 4) is represented in the Konkan (northwest coast of India, which incidentally is very near to the type locality, Mumbai) specimens as under:

Number of telson spines (Pairs)	Percentage frequency
1	12%
2	23%
3	61%
4	04%

The number of telson spines, therefore, cannot be treated as a valid character for separating the two forms.

According to Racek & Dall (1965), *P. stylifera coromandelica* possibly also differs

in possessing less number of rostral teeth i.e. 4 to 6 + 1 (epigastric). However, even this appears to be rather improbable since the rostral formula in the Konkan specimens is quite variable, being 3 to 6 + 1 (epigastric).

As already suggested by Racek and Dall (1965), apart from the above two features, i.e. number of telson spines and rostral formula, which in our opinion merely represents geographical variations, the two forms cannot be segregated by any other morphological characters including structure of petasma and thelycum (Figs. 35 - 38a, b & c). This observation is in complete agreement with that of George (1969a, 1979, 1980) who was indeed right in synonymising Alcock's form from the Coromandel coast with *P. stylifera* (H. Milne Edwards, 1837).

While he was able to settle the issue of Alcock's variety, George (1973) created his own new variety viz. *P. stylifera cochinensis* based solely on 15 males from the inshore waters of Cochin (Kerala). However, the size of specimens as mentioned by him i.e. the total length of merely 7.2 to 9.0 mm, appears to be indeed quite strange.

TABLE 4

COMPARISON OF *PARAPENAEOPSIS STYLIFERA* (H. MILNE EDWARDS, 1837) WITH THE OTHER FOUR SPECIES OF *PARAPENAEOPSIS* (?) COLLECTED ALONG THE KONKAN COAST

Characters	<i>P. stylifera</i> (H. Milne Edwards, 1837)	Other species of <i>Parapenaeopsis</i> (?) Konkan
1. Colour in fresh condition:		
(A) Transverse bands:	Absent.	Present.
(B) Sexual dimorphism:	Present.	Absent.
2. Fixed spines on telson:	Present.	Absent.
3. Distal unarmed portion of rostrum:	Present in both sexes.	Absent in both sexes or present only in females.
4. Fingers of Chelipeds:		
(A) First and Second chelipeds:	Shorter, being less than 1.5 (1.0 to 1.5) times palm.	Longer, being more than 1.5 (1.5 to 2.2) times palm.
(B) Third cheliped:	Shorter than (0.8 to 0.9 times) palm.	Longer than (1.0 to 1.6 times) palm.
5. Distolateral projection of petasma:	Longer than distomedian projection and directed laterally.	Generally shorter than distomedian projection and if longer, directed inwards but not laterally (as in <i>P.(?) cornuta</i> ).
6. A well developed leaf-like apical process on appendix masculina :	Present.	Absent.

In all probability this might be the result of a typographical error since it is almost impossible to conceive such small individuals even with traces of petasma or appendix masculina. Nevertheless, the figures of petasma and appendix masculina as given by George (1973, Fig. 1, b & d, p.422), completely tally with those of early developmental stages (approximately 45 mm size) of *P. stylifera* proper (Tirmizi, 1968, Fig. 2a-c, p. 195). This proves that George's Cochin specimens are merely young ones of *P. stylifera* as already pointed out by Ravindranath (1989).

Recently, Aravindakshan (1996) inferred that all the material known earlier from Mumbai (= Bombay) under the name *Parapenaeopsis stylifera* (H. Milne Edwards, 1837) actually belongs to a new species namely *P. mumbayensis* Aravindakshan, 1996. According to him, the new species is unique in possessing a : (1) Telson with lateral spines increasing in size distally (2) Uropods not tipped white (3) Abdomen with dorsal carination beginning from 4th segment onwards (4) Rostrum with 5 or 6 teeth.

However, all these four features fall well within the intraspecific variations exhibited by *Parapenaeopsis stylifera*, the type locality of which is Mumbai itself, a fact apparently overlooked by Aravindakshan (1996). Hence *P. mumbayensis* is synonymized under *Parapenaeopsis stylifera* herewith.

Another important aspect, which needs to be particularly stressed, is that *P. stylifera* distinctly differs from all other species assigned to the genus *Parapenaeopsis* (Alcock, 1901) in possessing well developed fixed spines on the telson, which are quite discernible even to the naked eye. In the present study it is found to differ in at least 8 important features, from the remaining 4 species assigned to the genus *Parapenaeopsis* {viz. *P. acclivirostris* Alcock, 1905, *P. cornuta* (Kishinouye, 1900), *P. sculptilis* (Heller, 1862) and *P. hardwickii* (Miers, 1878)} occurring along the Konkan coast (Table 4).

These differences are strong enough to suggest a separate taxonomic status for the remaining species and NOT for *P. stylifera* since it is not only the genotype but also the oldest known member of the genus *Parapenaeopsis*.

##### 5. *Acetes indicus* H. Milne Edwards, 1830

*Acetes indicus* H. Milne Edwards, 1830 : 351 (Type locality : Gangetic delta, India); *Acetes spiniger* - Hansen, 1919 : 43;? *Acetes indicus* - Achuthankutty & George, 1973 : 143.

**Material examined:** Numerous specimens purchased from Kalyan fish market {Thane district, near Mumbai (= Bombay)} on 6th May, 1990 : males (14.5 to 27.0 mm) and females (22.0 to 32.5 mm).

**Remarks:** Amongst the sergestids collected during the present study, *A. indicus* is by far the largest species. Although the original description by H. Milne Edwards (1830) is quite vague, it has been described in great detail by De Man (1917), Hansen (1919), Omori (1975) and Ravindranath (1980). Though all these workers have pointed out the presence of a characteristic needle-like process ventralis in the males of this species, Achuthankutty & George (1973) erroneously described it as lacking that process.

Nevertheless, two types of males, based on entirely different features, have been noted by Omori (1975) who was able to recognise a 'Large Form' (17.5 to 25.0 mm) belonging to the samples from East Asia as against the typical 'Small Form' (15.5 to 19.5 mm) from the Indo-Burmese region. He found several differences between the two forms, which are enlisted in Table 5.

The males in the present material, though size-wise (14.5 to 27.0 mm) definitely fall into Omori's 'Large Form', are in complete agreement with all the characters of his 'Small Form' except No. 1 of Table 5. In this respect, they are identical with the specimens from coastal Andhra Pradesh (Ravindranath, 1980). Further,

TABLE 5  
COMPARISON BETWEEN THE TYPICAL INDO-BURMESE FORM (= OMORI'S 'SMALL FORM')  
OF *ACETES INDICUS* H. MILNE EDWARDS, 1830, WITH THE EAST-ASIAN FORM  
(= OMORI'S 'LARGE FORM') ASSIGNED TO IT

Characters	Typical Indo-Burmese / 'Small form	East-Asian / 'Large Form'
1. Antennal scale:	Failing to reach tip of 2nd segment of antennular peduncle.	Extending beyond 2nd segment of antennular peduncle.
2. Lower antennular flagellum of male:		
(A) Clasping spine:	Long, slender, sharply curved and with only one row of tubercles	Short, stout, smoothly curved and with two rows of tubercles.
(B) Main branch:		
(i) First segment:	Without any spinules.	With one spinule.
(ii) Fourth segment:		
i) Armature:	With 6-8 spinules arranged only along distal 2/3rd of segment	With 8-10 spinules along its entire margin.
ii) Length:	Distinctly shorter than combined lengths of two preceding segments (i.e. 55-60 : 100).	Subequal to combined lengths of two preceding (i.e. 85-102 : 100):.
3. Petasma:	Without any traces of pars astringens.	With a vestigial pars astringens.
4. Appendix masculina:	With 2 hooks.	With 3 hooks.

it is seen that the Indo-Burmese form is characterised by sculpture of its capitulum, which is covered with numerous spinules as against that of its eastern counterpart which only bears a few apical spinules (Kemp, 1917; Hansen, 1919; Omori, 1975; Ravindranath, 1980 and pers. obs.).

All the above differences indicate that, although material at the disposal of Kemp (1917) and Hansen (1919) contained a few East-Asian specimens (= 'Large Form'), their good drawings are definitely based on the Typical Indo-Burmese specimens (= 'Small Form'). According to Omori (1975), "The differences between these two forms may be largely due to the difference at maturity". This, however, seems to be rather doubtful in our view as the differences between them are certainly not size-linked. On the contrary, they represent specific geographic stocks which may even warrant a separate taxonomic status for the East-Asian 'Large Form'.

#### 6. *Acetes sibogae* (?) Hansen, 1919 (Figs. 39-53)

*Acetes sibogae* Hansen, 1919 : 38 (Type locality : Bay of Bima and Bawean island, Indonesia); *Acetes erythraeus* - Kemp, 1917 : 51 (part); *Acetes sibogae* - Burkenroad, 1935 : 126; ? *Acetes australis* - Colefax, 1940 : 345 ; ? *Acetes sibogalis* - Achuthankutty & George, 1973 : 139; ? *Acetes sibogae sibogae* - Omori, 1975 : 61; ? *Acetes sibogae sibogalis* - Omori, 1975 : 66; ? *Acetes sibogae australis* - Omori, 1975 : 68 ; *Acetes vulgaris* - Achuthankutty, 1975 : 469; ? *Acetes orientalis* - Achuthankutty & Nair, 1976 : 233.

**Material examined:** 12 samples containing numerous specimens collected from Zadgaon creek, Ratnagiri, from April 1989 to May 1991 : males (14.5 to 29.0 mm) and females (16.5 to 29.5 mm).

**Remarks:** *A. sibogae* s.l. is a highly variable species, the true status of which has been



confused by the creation of several species and subspecies as much as by the relegation of some really distinct species under it. In fact, both Omori (1975, 1977) and Ravindranath (1980) have extensively discussed this problem of *A. sibogae* complex to which presently several nominal species like *A. australis*, *A. sibogalis*, *A. orientalis* etc. have been assigned, besides relegation of forms like *A. vulgaris*. Perhaps, this confusion seems to be due to inadequate observations or understanding of taxonomic features. For example, the number of falcate spines on petasma (Fig. 50) which is a specific feature was apparently wrongly observed (due to improper mounting as in Figs. 43 & 51) by Ravindranath (1980) as evident from his Fig. 9c & d, p. 268. On the other hand, undue importance given to features like number of segments on lower antennular flagellum, nature of third thoracic sternite of females etc. by authors like Achuthankutty & George (1973) and Achuthankutty & Nair (1976) seems to have led to the erroneous creation of different species.

The present material, when compared with the available literature, is found to be identical only with Ravindranath's (1980) description based on an east coast form from coastal Andhra Pradesh, in exhibiting a characteristic sexual dimorphism of the basal spine of third pereopod (found only in these two forms) which is present and well developed in females but absent in males (Figs. 44, 45). Although Ravindranath (1980) seems to doubt the taxonomic validity of this

spine (since he found it to be present in one male specimen of 18.8 mm), Pathansali (1966) had already stressed its diagnostic value at species level. In the present study, this spine is consistently absent in a large series of males examined.

The similarity of the present material with the widely separated east coast form, instead of any of the so far known west coast forms, clearly proves that the nature of presence or absence of basal spine of third pereopod is of definite specific value and cannot be simply ascribed to geographic variation.

The Ratnagiri material (along with Ravindranath's specimens from east coast of India) further differs from the remaining forms in the following:

1. Pars astringens distinctly smaller than pars externa.
2. Tips of capitulum beset with several minute spinules (Figs. 43, 50 & 51).

The Ratnagiri and Andhra Pradesh specimens, therefore, merit distinct taxonomic identity.

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